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Abstract entitled:

LONG TERM EFFECTS OF FOOD SUPPLEMENTATION AND PSYCHOSOCIAL STIMULATION UNDER 2 YEARS OF AGE ON GROWTH AND COGNITIVE DEVELOPMENT OF INDONESIAN CHILDREN (A FOLLOW-UP STUDY)

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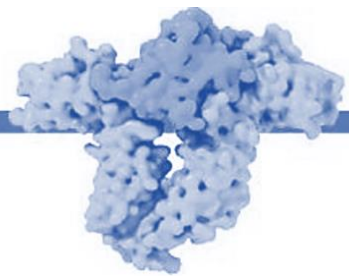

Long term effects of food supplementation and psychosocial stimulation under 2 years of age on growth and cognitive development of Indonesian children (A follow-up study)

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Background : Stunting remains a prominent global health problems which need great concern. Interventions initiated before 2 years of age can prevent stunting and greatly benefit nutritional status in the next period of life.The aim of the study to evaluated the effect of food supplementation and psychosocial stimulation for children under 2 years in West Sumatra province, Indonesia

Methods : This study which was the following up of the previous study (2013). There were 140 children recruited through cluster random sampling. It was conducted from August 2016 to August 2017. Nutritional assessment was conducted after dividing the sample population into four groups according to the type of intervention received: 1) Food Supplementation (FS) group, 2) Psychosocial Stimulation (PS) group, 3) Food Supplementation and Psychosocial Stimulation (FS +PS) group, and 4) Control (CG) group. The data are analysed based on one way ANOVA and linear regression.

Results : The children (aged 37–59 months) showed the weight gain about 14.8±2.4 kg (95% CI; 14.4 - 15.2). The height after the following-up was 97.3±8.3 cm (95% CI; 95.9 – 98.7), increase about 23.2±7.7 cm (95% CI; 21.9 – 24.4). Significantly, differences were found in the nutritional status of children, using the z-scores based on the height for age index, with an increase as large as -0.19 (p<0.01) and cognitive development (p<0.01) . This was found in the combined food supplementation and psychosocial stimulation group

Conclusions : Combined food supplementation and psychosocial stimulation based on had long term effect on linier growth and cognitive development of the children.

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Keywords : food supplementation, psychosocial stimulation, nutritional status, cognitive development, children, Indonesia

INTRODUCTION

Stunting remains a prominent global health problem with important consequences for survival, incident acute and chronic diseases, healthy development, and the economic productivity of individuals and communities.[1] The 2013 Basic Health National Survey revealed a 37% prevalence of stunting in children aged under 5 years in Indonesia.[2] From the conception until 2 years of age, children grow and develop rapidly[4] and have high nutritional demands. Most growth-faltering events occur during this period of life, and low birth weight contributes to early faltering. Nutritional problems occurring prenatally or during early childhood not only increase the risk of infant morbidity and mortality but also affect the long-term growth and development of children.[3]Early life interventions initiated before 2 years of agefor preventing growth failure and supporting the optimal growth and development of children are therefore crucial.[5]

Intervention studies of nutritional supplementation and psychosocial stimulation are conducted for Indonesian children development.[6, 7] Interventions initiated before 2 years of age can prevent stunting and greatly benefit nutritional status in the next period of life. A 6-monthintervention involving food supplementation and psychosocial stimulation performed according to the local culture was provided for children aged 6–9 months in West Sumatera Province. The present follow-up study evaluated the sustainable effects of the local food supplementation and psychosocial stimulation initiated at before 2 years of age and the nutritional status of children aged 3–5 years inWest Sumatera Province, Indonesia.

METHODS

Study design and subject

Three year follow-up study of randomized controlled trial was performed from August 2015 to August 2017. In 2013, a quasi-experimental randomized controlled trial was conducted in Tanah Datar district, West Sumatera, Indonesia. 355 children aged 6-9 months were identified at enrollment and they were randomly divided into four groups, namely 1)Food Supplementation Group (FS); 2)Psychosocial Stimulation Group (PS); 3)Food Supplementation and Psychosocial Stimulation Group (FS+PS); and 4) Control Group (CG). The order of group assignment was randomly for six months of intervention and 271 children were available in endline.[12] The subject of this follow-up study comprised all children from the previous study and the total sample size was 140 children. Sampling was conducted in randomized stages (cluster random sampling), and the nutritional status of the participants was measured.

Follow-up measurements

All children and their mothers were visited weekly by a trained health worker to monitor and reinforce compliance with the two intervention programs. During the visits, mothers or caregivers in the psychosocial stimulation and combined nutrition supplementation plus psychosocial stimulation groups performed *Manjujai* with their children at home. Other family members of the children were also encouraged to do so,

becausein Minangkabau culture, other family members are usually involved in activities related to child care. The preparation of food supplements in the nutrition supplementation and combined nutrition supplementation plus psychosocial stimulation groups was monitored by assistant researchers. In addition, they were expected to help resolve any problem food by mothers. Compliance data for food supplements usage and psychosocial stimulation were recorded for monthly evaluation. After 1 year (endpoint of the intervention), the follow-up study had been done when children aged 4 years. The follow-up measurements included the nutritional status of the children was measured using Z-scores based on weight-for-age (WAZ), height-for-age (HAZ), and weight-for-height (WHZ) indexes, the quality of psychosocial stimulation used HOME inventory assessment for children aged 4 years, and measured of cognitive development of children.

Anthropometry

All anthropometric measurements were performed by two trained dietitians who used standard techniques described by Gibson.[12] Before and during the study, the dietitians' performance as interviewers was monitored. With regard to the 20 children,the inter observer reliability between the interviewer and researchers was high. Anthropometric measurements were taken at endpoint of intervention at aged under 2 years and the follow-up measurement of anthropometric at aged 4 years of the children. The body weight of the children, who wore light clothes without shoes, was measured using an electronic scale (to a precision of 0.1 kg). The length of the recumbent children aged under 2 years was recorded using a measuring board (to a precision of 0.1 cm) and the stature children up 2 years was asses using a microtoise height measurement to the nearest 0.1 cm. .

Statistical analysis

The data were analyzed using SPSS-Win, version 20 (SPSS Inc. Chicago, IL, USA). After data collection, cleaning, and coding, data entry was performed. The normal distribution of continuous data was assessed using the Kolmogorov–Smirnov test of normality. Anthropometric indices were calculated usingthe WHO Anthro 2005 software and expressed as mean±SD of the Z-score for the WAZ, HAZ, and WHZ. Paired-sample *t* test was used to compare the groups at baseline to confirm the homogeneity within groups in terms of nutritional status. Statistical comparisons were performed using the Wilcoxon signed rank test and the Kruskal–Wallis test for variables that were not normally distributed. Group comparisons (control vs intervention groups) were performed using the independent-sample *t* test for continuous variables and chi-square test for categorical variables. The characteristics of the groups were compared through ANOVA. The linier regression was applied to measure the differences in Z-score WAZ, HAZ, WHZ of nutritional status of children in each group at endpoint intervention and the follow-up.

RESULTS

In the previous study conducted in January–December 2013, 271 children were included in the analysis. The reasons for unavailability were loss to follow-up, mainly due to migration out of the residential area or to other towns; refusal from the children' parents; and death (n=1) during the study. During the last three years follow-up after the endpoint intervention of the previous study, table 2 showed that children in FS+PS group had the highest height ($P<0.01$) and good cognitive status compared to other groups ($P<0.05$) . The table 2 also showed that nutrition care and health status of the children among the groups were not significant.

The nutritional status of children according Z-score WAZ, HAZ and WHZ at baseline, endpoint of intervention and follow-up showed in table 3. The nutritional status of children used Z-score HAZ about 1.54±0.83 at endpoint of intervention and decrease about -1.42±0.78

at follow-up founded in FS+PS group also showed in table 3.

Figure 1 showed that Z-score HAZ the FS+PS group had been consistent Z-score of Height for Age (HAZ) during the last three years, from -1.5 to -1.4 when compared to three other groups after controlled by various confounding variables. Besides that figure 1 shows that there was a decrease in the mean score of Z-score HAZ in the FS+PS group compared the C group with difference about 0.310 from the linier regression calculation. Figure 2 and 3 that showed there are no significant differences after linear regression of Z-score for WAZ and WHZ of all groups.

DISCUSSION

Combined food supplementation and psychosocial stimulation or*Manjujai*had a positive effect on linear growth of nutritionalstatus ofthe children. In the present follow-up study, combined food supplementation and psychosocial stimulation were consistent with height for age index of nutritional status of children. It can increase weight and height within 6 months, but it is less effective in assisting the linear growth (catch-up) of stunted children within a limited time frame. The acceleration of linear growth is difficult if an infant lives in a poor neighborhood. Nevertheless, height potential defies determination ahead of puberty,[13,14] even in retrospect. The question of optimal height is currently under scrutiny and has implications for the efforts to address the perceived problem of stunting, which often mistakenly involves those who are healthily short.

The limitations of this study showed that only 140 children out of all children who after study intervention in 2013. There were 131 children who did not get involved in follow-up study because several conditions which included remote geographic location the children stayed.

Astudy in Bangladesh reported that children who were given food supplements did not exhibita change in linear growth, because the children continued to be in a state of malnutrition and remained stunted even after 6 months of intervention. This study concluded that combined nutritional supplementation and psychosocial stimulation should be pursued for longer periods.[15]

Nutritional supplementation for 3 months in children aged 12–18 monthsin Bogor, Indonesiahada positive effect on body weight, but a longer period (12 months) of supplementation with additional micro-nutrients wereneeded to improve body length.[16] Nevertheless, combined food supplementation and psychosocial stimulation could minimize growth faltering in children in order to reach WHO standards.[5,17]

One previous study reported that the long-term effect of nutritional supplementation combined with psychosocial stimulation in early life was associated with nutritional status for the next period of life in children.[18]A sub-scale of the indicators for environmental practices,which foster psychosocial stimulation, identifies parents or caregivers responsiveness to the emotional and verbal needs of children.[19]

In the first 2 years of life,the growth and brain development of children are sensitive to adequate nutrition and psychosocial stimulation.[20,21]Therefore, food supplementation and psychosocial stimulation performed according to the local culture should be consistently and regularly applied for a more holistic and integrated approach to infantgrowth and development.

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AUTHOR DISCLOSURES

The authors declare that they have no conflicts of interest. The views expressed herein are those of the individual authors and not attributable to any supporting organization.

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Table 1. Characteristics of the children were stratified by the type of treatment provided in 2013 (n=271)

Variables	FS-group (Mean±SD)	PS-group (Mean±SD)	FS+PS-group (Mean±SD)	C-group (Mean±SD)	*p* value*
Age (mo)					
Baseline	7.51±1.20	7.58±1.14	7.64±1.29	7.77±1.25	0.650
Endline	13.32±1.31	13.48±1.33	13.92±1.41	13.77±1.44	0.264
Birth weight (kg)	3.09±0.41	3.03±0.34	3.05±0.38	2.99±0.37	0.393
Birth length (cm)	47.92±4.81	48.29±3.39	48.16±2.89	48.36±2.22	0.191
Birth order	2.34±1.47	2.42±1.26	2.13±1.01	2.09±1.04	0.579
Birth weight status					
Low birth weight (≤2500 g), n (%)	5 (6.9)	7 (11.9)	9 (13.0)	9 (12.7)	0.628
Normal (>2500 g), n (%)	67 (93.1)	52 (88.1)	60 (87.0)	62 (87.3)	
Birth length status					
Stunting (≤45 cm), n (%)	2 (2.8)	9 (15.3)	6 (8.7)	6 (8.5)	0.089
Normal (>45 cm), n (%)	70 (97.2)	50 (84.7)	63 (91.3)	65 (91.5)	
Exclusive BF					
Yes, n (%)	41 (56.9)	25 (24.4)	31 (44.9)	43 (60.6)	0.096
No, n (%)	31 (43.1)	34 (57.6)	38 (55.1)	4 (60.6)	
Health Status					
Fever/ARI	4.65±3.30	5.61±5.42	4.60±3.22	5.41±4.80	0.879
Diarrhea (day)	5.11±3.82	4.50±2.80	3.63±1.71	2.53±1.90	0.070

Table 2. Nutritional status of children based on Z-score at follow-up (n=140)

Variables	FS-group (n=36)	PS-group (n=36)	FS+PS-group (n=36)	C-group (n=32)	p value
Age (month)	47.5±1.2	46.8±2.4	49.9±3.8	51.5±.41	0.000
Birth order	2.1±1.0	2.7±1.7	2.2±1.1	2.1±0.9	0.221
Weight (kg)	14.4±1.2	14.4±1.6	14.8±2.2	14.5±1.8	0.746
Height (cm)	96.2±3.7	94.3±3.8	98.1±5.1	94.4±4.6	0.005
Sex, n (%)					
Boy	16(25.8)	17(27.4)	18(29.0)	11(17.7)	0.240
Girl	14(34.1)	12(29.3)	11(26.8)	4(9.8)	
Nutrition Care, n (%)					
Low	11(31.4)	7(20.0)	10(28.8)	7(20.0)	0.470
High	19(27.9)	22(32.4)	19(27.9)	8(11.8)	
Health Status, n (%)					
Low	19(82.7)	17(79.1)	15(27.3)	6(10.9)	0.264
High	11(23.9)	12(26.1)	14(30.4)	9(19.6)	
Cognitive Status, n (%)					
Poor	17(34.0)	19(38.0)	10(20.0)	4(8.0)	0.028
Good	13(24.5)	10(18.9)	19(35.8)	11(20.8)	

Table 3. Nutritional status of children, according to the Z-scores Enrollment, Endpoint and Follow-up

Variables	FS-group	PS-group	FS+PS-group	C-group
Weight for age				
Enrolment (< 1 yo)	-0.54±0.91	-0.64±1.14	-0.76±0.80	-0.70±0.45
Endpoint intervention (< 2 yo)	-0.94±0.88	-0.71±1.05	-0.99±0.59	-0.91±0.12
follow-up (3-4 yo)	-0.90±0.93	-0.65±0.99	-0.87±0.64	-0.73±0.97

Height for age				
Enrolment (< 1 yo)	-0.64±0.98	-0.60±1.21	-0.07±0.85	-0.48±0.42
Endpoint intervention (< 2 yo)	-0.60±0.95	-1.18±1.11	-1.54±0.83	-2.12±0.60
follow-up (3-4 yo)	-0.93±0.97	-0.91±0.89	-1.42±0.78	-1.35±1.32
Weight for Height				
Enrolment (< 1 yo)	-0.18±1.04	-0.34±1.05	-0.89±1.11	-0.51±0.67
Endpoint intervention (< 2 yo)	-0.83±1.21	-0.10±0.92	-0.30±0.64	0.26±0.33
follow-up (3-4 yo)	-0.63±1.01	-0.31±1.06	-0.29±0.72	-0.81±0.29

FS: nutritional supplementation; PS: psychosocial stimulation; FS+PS: combined nutritional supplementation and psychosocial stimulation; CG: control group.

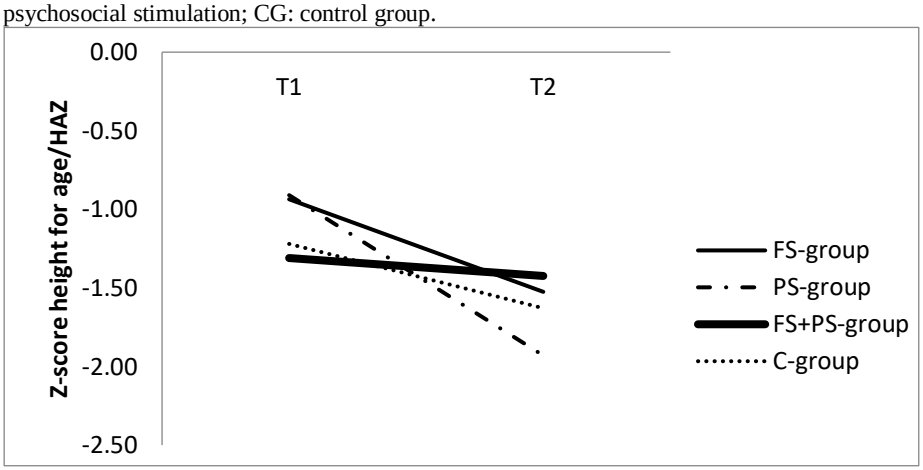

Figure 1: Nutritional Status according to the Z-scores HAZ of Children at Endpoint (T1) and Follow-up (T2)

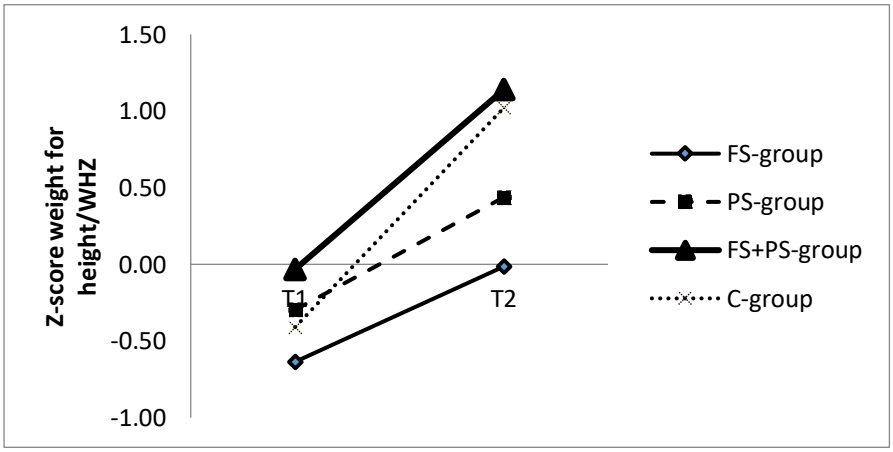

Figure 2: Nutritional Status according to the Z-scoresWHZ of Children Endpoint (T1) and Follow-up (T2)

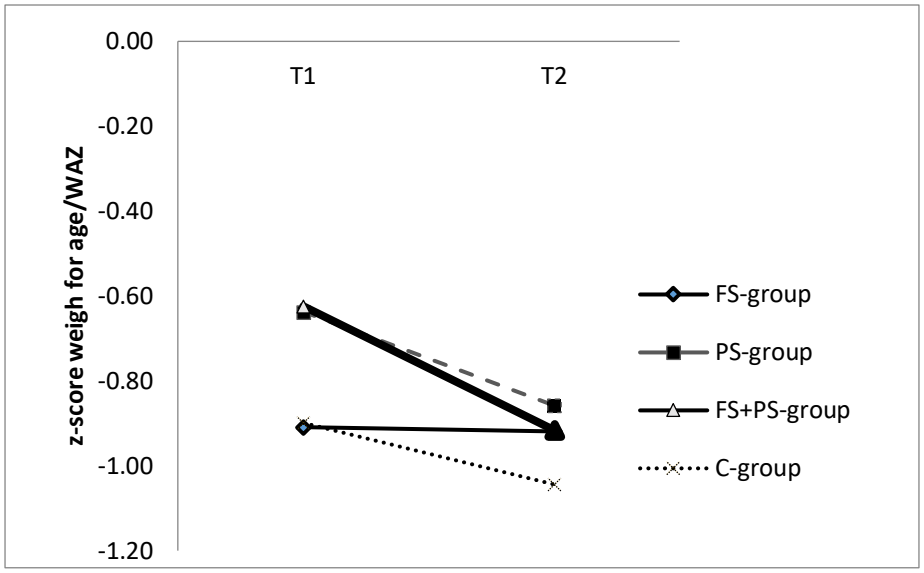

Figure 3: Nutritional Status according to the Z-scoresWAZ of Children Endpoint (T1) and Follow-up (T2)